

(f) Any variation from the specifications in this subpart, including performance specifications and emission detection methods, may be used only with prior approval by the Administrator.

(g) Additional components, such as instruments, valves, solenoids, pumps, switches, and so forth, may be employed to provide additional information and coordinate the functions of the component systems.

(h) The following requirements must be incorporated in each system used for raw testing under this subpart.

(1) Take the sample for all components with one sample probe and split it internally to the different analyzers.

(2) Heat the sample transport system from the engine exhaust pipe to the HC analyzer for the raw gas sampling method as indicated in Figure 1 in Appendix B of this subpart. The NO<sub>x</sub> analyzer for the raw gas sampling method may be heated as indicated in Figure 1 in Appendix B of this subpart. The HC analyzer and the NO<sub>x</sub> analyzer for the dilute sampling method may be heated as indicated in Figure 1 in Appendix B of this subpart.

#### **§ 90.415 Raw gaseous sampling procedures.**

Fit all heated sampling lines with a heated filter to extract solid particles from the flow of gas required for analysis. The sample line for HC measurement must be heated. The sample line for CO, CO<sub>2</sub> and NO<sub>x</sub> analysis may be heated or unheated.

#### **§ 90.416 Intake air flow measurement specifications.**

(a) If used, the engine intake air flow measurement method used must have a range large enough to accurately measure the air flow over the engine operating range during the test. Overall measurement accuracy must be two percent of full-scale value of the measurement device for all modes except the idle mode. For the idle mode, the measurement accuracy must be  $\pm$  five percent or less of the full-scale value. The Administrator must be advised of the method used prior to testing.

(b) When an engine system incorporates devices that affect the air flow measurement (such as air bleeds, air

injection, pulsed air, and so forth) resulting in understated exhaust emission results, make corrections to the exhaust emission results to account for such effects.

#### **§ 90.417 Fuel flow measurement specifications.**

(a) Fuel flow measurement is required only for raw testing. Fuel flow is allowed for dilute testing. If the measured fuel flow is used in the dilute calculations for brake-specific fuel consumption (see § 90.426(e)), the fuel flow instrument must meet the requirements of this section.

(b) The fuel flow measurement instrument must have a minimum accuracy of one percent of full-scale flow rate for each measurement range used. An exception is allowed for the idle mode. For this mode, the minimum accuracy is  $\pm$  five percent of full-scale flow rate for the measurement range used. The controlling parameters are the elapsed time measurement of the event and the weight or volume measurement.

#### **§ 90.418 Data evaluation for gaseous emissions.**

For the evaluation of the gaseous emissions recording, record the last four minutes of each mode and determine the average values for HC, CO, CO<sub>2</sub> and NO<sub>x</sub> during each mode from the average concentration readings determined from the corresponding calibration data. Longer averaging times are acceptable, but the sampling period which is reported must be a continuous set of data.

#### **§ 90.419 Raw emission sampling calculations—gasoline fueled engines.**

(a) Derive the final weighted brake-specific mass emission rates (g/kW-hr) through the steps described in this section.

(b) *Air and fuel flow method.* If both air and fuel flow mass rates are measured, use the following equations to determine the weighted emission values for the test engine: